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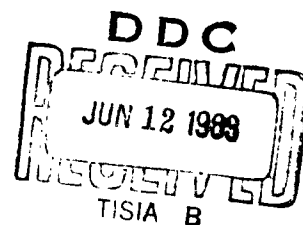
Report No. 8926-158

Material - Adhesives - Structural - Metlbond 4021

Effect of Genitian Violet Dye on Tensile Shear Strength

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Effect of Genitian Violet Dye on Tensile Shear Strength

Abstract:

The addition of 0.1 per cent genitian violet to Metlbond 4021 adhesive primer (Narmco Resins and Coatings Inc.) was evaluated with respect to its effect on the strength of metal to metal bonds. Tensile-shear tests made in accordance with Specification Mil-A-5090B were made to compare tinted with un-tinted primers used in the preparation of joints which were bonded at 275°F under a pressure of 100 psi. The comparative test results showed that the dye did not adversely affect the Metlbond 4021 primer.

Reference: Lintvedt, V., Miyaji, M. C., Sutherland, W. M.,
"Tensile-Shear Strength of Tinted Metlbond Primer,"
General Dynamics/Convair Report MP 56-39, San Diego,
California, 26 July 1957. (Reference attached).

ANALYSIS

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REPORT NO. 56-39
TENSILE-SHEAR STRENGTH OF
TINTED METLBOND PRIMER

INTRODUCTION:

Shop personnel suggested the use of dye in adhesive primers for easy identification of primer in the liquid state and on primed parts before bonding. Preliminary tests by Narmco indicated that gentian violet did not adversely affect the bond strength of their Metlbond 4021 system.

OBJECT:

To determine the practicability of using 0.1% gentian violet in Metlbond 4021 adhesive primer to facilitate identification, inspection, and control of the spraying process.

CONCLUSION:

Tinting of Metlbond 4021 Type II primer with 0.1% gentian violet does not adversely affect the bond strength.

It is feasible to use this dye to facilitate application, identification, and inspection of Metlbond primer.

TEST SPECIMEN:

Material - .064" 2024T3 Alclad

Dimensions - 1/2" overlap tensile shear as specified in MIL-A-5090B

Tape - Narmco's Metlbond 4021 type I, Batch 146 Roll-13 (Later test groups M, N, and O were bonded with Batch 211 Roll 6)

Surface Preparation - All samples except those groups listed below cleaned and Alodized (600) in Dept. 31 processing tanks according to Convair Spec. 8-07308. Group D-2 was cleaned by immersion in water - sulfuric acid - sodium dichromate (30-10-1 parts by wt.) cleaning solution and was not Alodized. Groups M through R were cleaned and Alodized in laboratory solutions in the Materials and Processes Laboratory.

Bonding Procedure - All groups except the last six (M through R) placed in a press which was at 200°F. or lower and allowed to heat up to the bonding temperature under pressure. The last six groups were placed in a press which was preheated to 275°F. and the 100 psi pressure quickly applied. The silicone rubber strips were taped to the bottom of the panels so that very little heat was applied to the panels until they contacted the upper platen.

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TEST PROCEDURE:

Tensile-shear testing was done on a Tinius-Olsen machine with a tank adaptor to provide a temperature controlled bath for low and elevated temperatures.

Tensile-shear creep tests were conducted by the use of spring loaded tension applying levers placed in an oven. Creep measurements were made by microscopic examination (using a calibrated eyepiece) of lines scribed across the bond on the edge of the overlap. A direct reading extensometer was made which operates on a zero gauge length and permits reading of deformation at any time. The values obtained with this extensometer were compared with those of the microscope. Specimens were selected at random for each test.

Tests of groups J, H, and L were added to the original tests to furnish more data comparing tinted and untinted primers in low temperature tensile shear tests.

DISCUSSION OF RESULTS:

The gentian violet provided sufficient color to easily identify the primer and showed some color change in prime baking.

The direct reading extensometer values differed from the microscope readings by 0.7 mil. In a subsequent test, play developed between the supporting pins and their bearings. This resulted in a discrepancy of two mils.

Omitting of Alodized surface treatment in the case of group D-2 produced high -67°F. tensile shear values. This is further evidence that the gentian violet does not adversely affect the bond.

Data shown in Table IV indicates that with a good sample of tape, carefully controlled processing solutions, and a desirable bonding cycle a very high shear strength at -67°F. can be attained. There is no significant difference in the tinted and the untinted prime in the results of these salt spray and humidity exposure tests.

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TABLE I

Tensile Shear Results Using Tinted Matlbond Primer

Group A
 Tinted
 Test Temp. -67°F.

PSI
 1510
 2115
 2210
 2150
 2270
 2160
 2165
 1960
 Ave. 2068

Group B
 Tinted
 Test Temp. -67°F.
 30 Days Salt Spray

PSI
 2005
 1540
 2215
 1960
 2115
 1885
 1645
 1710
 Ave. 1884

Group C
 Tinted
 Test Temp. -67°F.
 168 Hrs. of 100%
 Humidity

PSI
 2250
 2165
 1845
 2040
 1625
 2690
 2000
 2115
 Ave. 2091

Group D
 Tinted
 Room Temp. Test
PSI

4565
 4460
 4525
 4640
 3970
 4640
 4690
 4400
 Ave. 4486

Group E
 Tinted
 Test Temp. +300°F.
PSI

1820
 2020
 1765
 1780
 1535
 1845
 1805
 1835
 Ave. 1801

Group J
 Tinted
 Test Temp. -67°F.
PSI
 2155
 2257
 2068
 2529
 Ave. 2252

Group D-2 (Special Surface Treatment
 Tinted FPL Cleaning)
 Test Temp. -67°F.
PSI

3940
 3880
 1860
 4235
 2120
 4314
 4088
 3817
 Ave. 3544

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TABLE II

Tensile Shear Results Using Untinted Matlbond 2021 Primer

Group G
Test Temp. -67°F.
30 Days of Salt Spray
PSI

1485
1330
2220
2185
2165
1325
1715
1970

Ave. 1799

Group H
Test Temp. -67°F.
168 Hours 100% Humidity
PSI

2900
3385
2170
2170
2650
3450
1800
3430

Ave. 2744

Group L
Test Temp. -67°F.
PSI

2149
2070
2772
2592
Ave. 2396

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TABLE III

TENSILE SHEAR CREEP

Load --- 900 Psi
 Test Temperature - 300°F.
 Time under load and temperature - 192 hours

<u>TINTED</u> <u>GROUP F</u>		<u>UNTINTED</u> <u>GROUP I</u>	
<u>Sample No.</u>	<u>Creep Deformation</u> <u>Mils</u>	<u>Sample No.</u>	<u>Creep Deformation</u> <u>Mils</u>
1	7.	1	8.5
2	6.5	2	5.5
3	9.5	3	6.5
4	10.5	4	8.
5	6.5	5	6.5
6	11.5	6	7.
7	9.5	7	7.
8	Sample broke under load	8	6.5
Ave. excluding No. 8 - 8.7		Ave. 6.9	

Extensometer Readings
for No. 6 of Group F Above

<u>Time In Oven</u>	<u>Deformation Mils.</u>
15 min.	6.0
1 hour	10.0
16 hours	11.7
72 hours	12.0
192 hours	12.2

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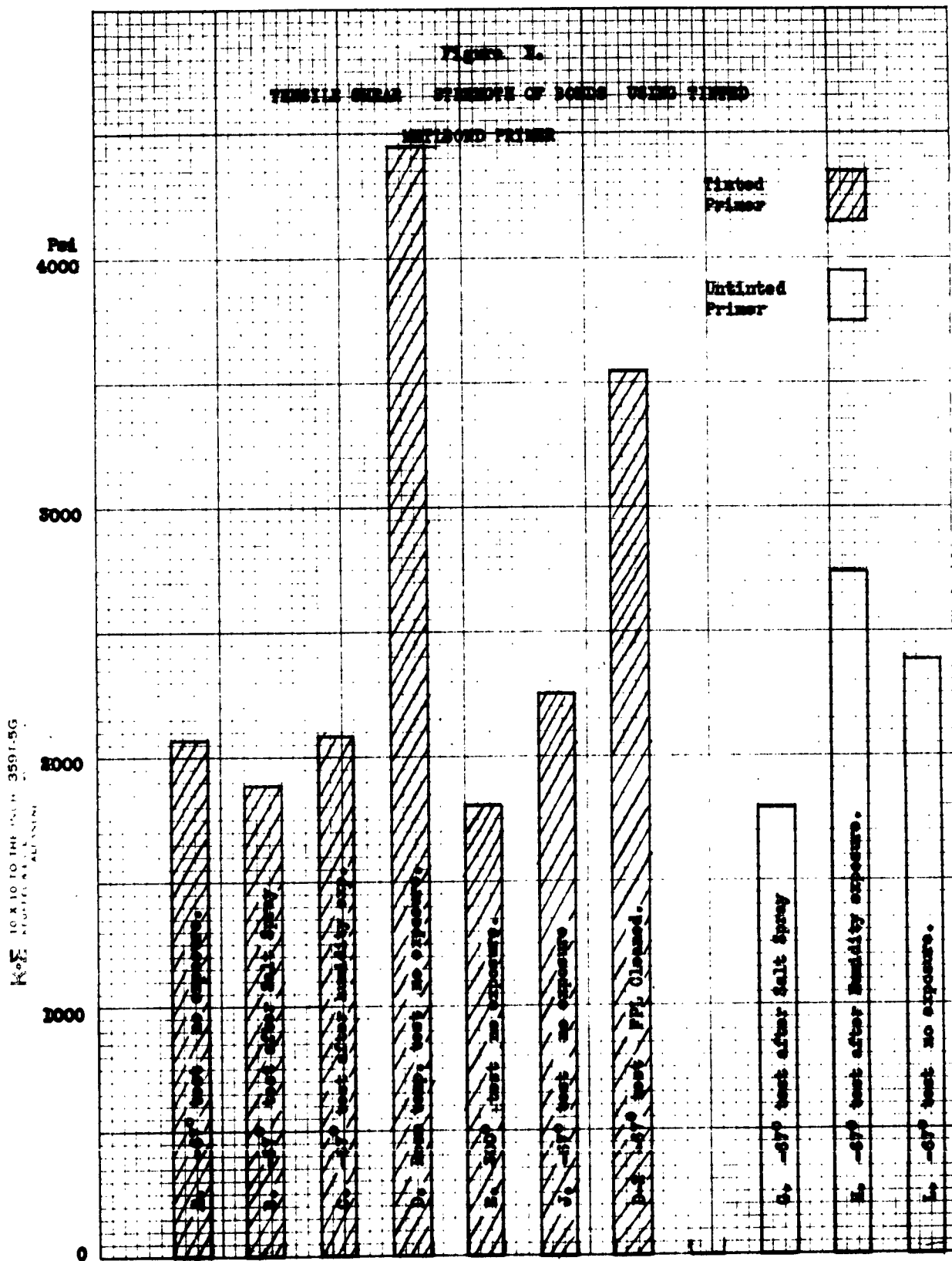
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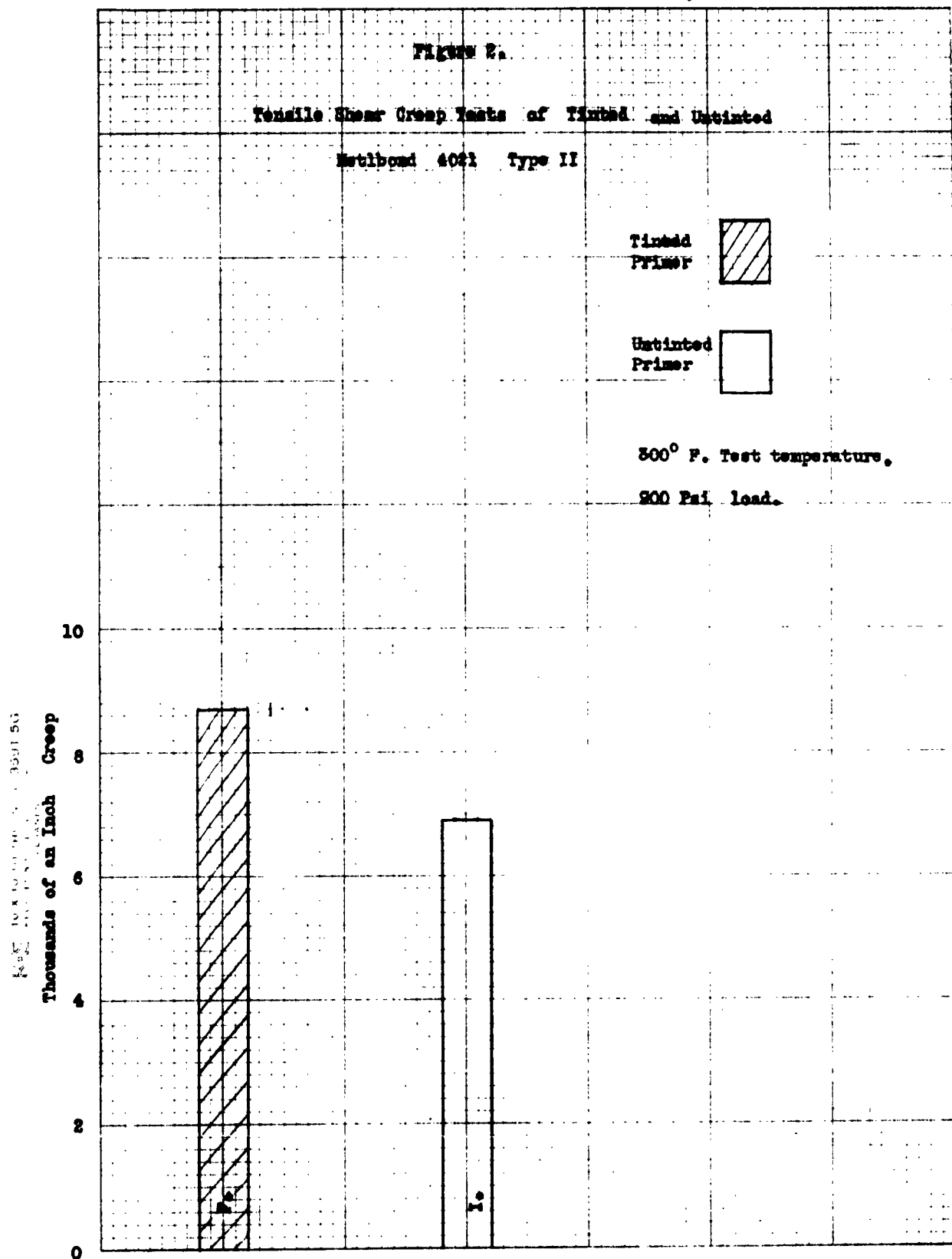
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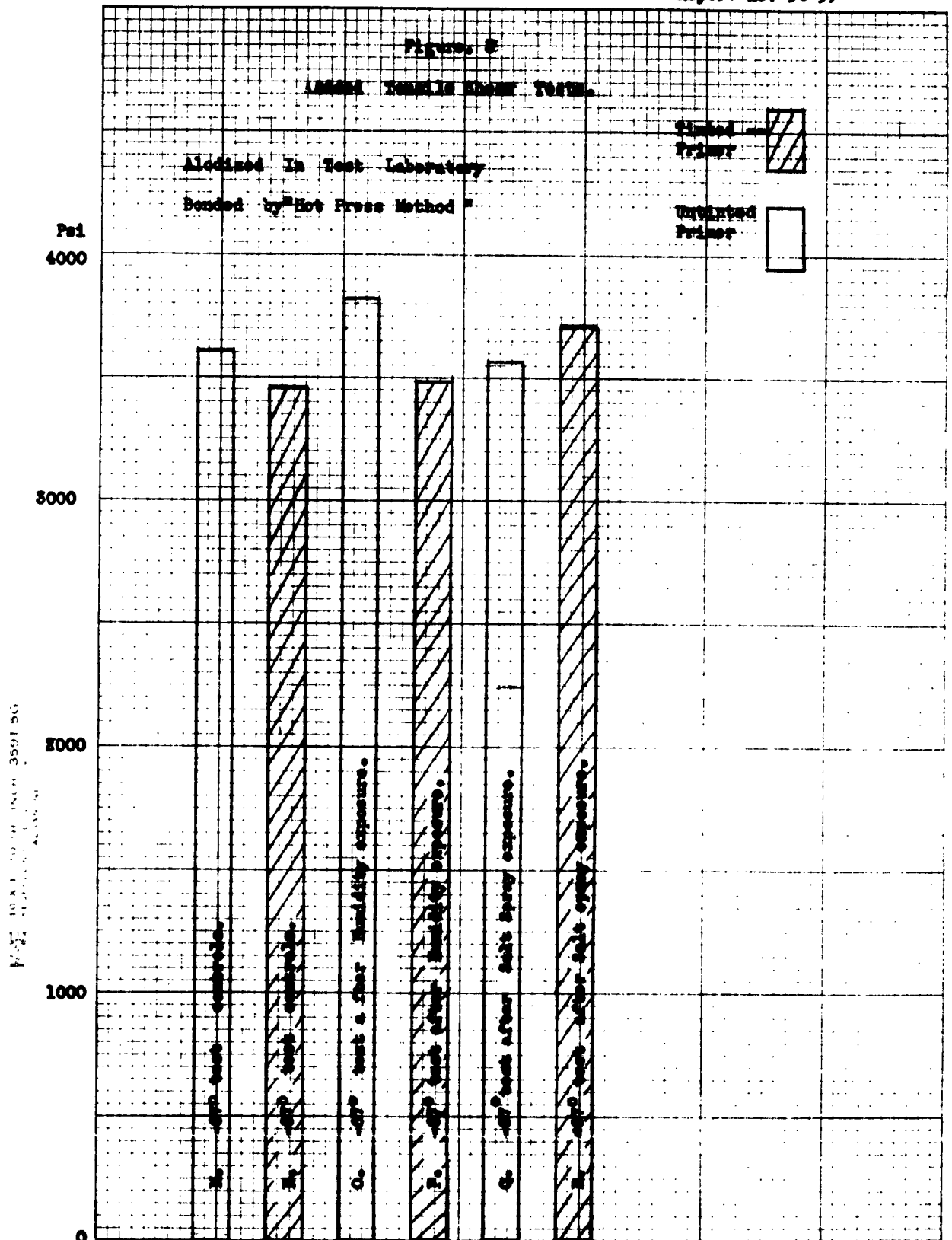
TABLE IV

Results of Tensile Shear Tests At -67°F. Using Lab Alodine
 And A Preheated Press

CONTROLS		Tested After 168 Hours Exposure to 100% Relative Humidity	
Untinted	Tinted	Untinted	Tinted
M	N	O	P
3231	2577	2462	3933
2735	2696	2157	4124
3577	2240	4471	3733
3569	3840	3952	4585
3885	4587	2580	3943
4069	4078	4385	4192
3942	4060	3490	4077
4510	2304	3353	4297
3404	2235	3685	2129
3185	3814	4904	2510
4558	3550	2906	2564
2406	4010	4558	2218
3283	4333	2790	2510
4029	4215	2631	2337
Ave. 3613	Ave. 3467	3514	4198
30 Days Salt Spray Exposure		4317	4371
Untinted	Tinted	2088	3095
Q	R	4269	3897
2844	4276	3728	2933
3185	4571	3943	4305
4414	4596	3913	2760
3038	2935	4667	4210
3410	4692	4703	3077
3762	4414	4208	4178
3057	3324	4447	2202
3219	3555	4752	4466
4706	2455	4654	2058
3010	4425	4314	4602
3693	3119		4706
3882	2718	Ave. 3825	Ave. 3494
3381	2846		
2816	4150		
4379			
4187			
Ave. 3561	Ave. 3720		







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Figure 4.

